

Chemical Pathology User Guide

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Opening Hours

TGH 8.45am - 5.00pm Mon-Fri

TGH 8.45am – 12.30pm Sat

Biomedical Scientist on call 7am – 8.45am and 5.00pm – 12.30am

(Bleep 069 through hospital switchboard)

The laboratory is situated at the rear of Trafford General Hospital, off the main corridor, and is clearly signposted.

Specimen reception is located by the entrance, and the Chemical Pathology laboratory is also located on the lower floor

Contact

Dr. Lance N. Sandle	0161 746 2473
Consultant Chemical Pathologist	
PA to Dr Sandle	0161 746 2470
Gillian Tranter	0161 746 2482
Head BMS	
Christine Hill	0161 701 1201
Laboratory Manager	
“Urgent” and profile enquiries	0161 746 2494
General Enquiries	0161 746 2480
Out of hours bleep	069
Main Pathology Reception	0161 746 2495

Request Forms

Electronic requesting should be used where available, using the ICE system.

Where this is not possible, there is a combined Hospital Pathology request form which may be hand-written.

The patient's full name and date of birth must be clearly visible and legible on both request form and specimen.

Identification Criteria

	Essential	Desirable
Sample	Patients full name or correctly coded identification Date of Birth Date collected	Time sample taken (sometimes essential) Hospital or NHS Number
Request Form	Patients full name or correctly coded identification Date of birth Sex of patient Report destination Requesting Consultant or GP (including computer code) Date collected Electronic record or NHS number – or address if unknown	Clinicians bleep No Signature of requesting Clinician Patients address Clinical details Time collected

The requesters name and report destination must be clearly printed to allow reports to be returned to the appropriate location.

Specimens must be placed into the bag and sealed correctly. Please see the Pathology Sample Acceptance Criteria for further details.

Collection and Transportation of specimens

The 'Monovette' blood collecting system, comprising a combined syringe/container and a needle with valve for multiple samples, is used. If difficulties are experienced, contact the phlebotomy department (0161 746 2448) or the laboratory.

Sharing of samples with other departments is not acceptable and will result in samples not being analysed for all tests.

Specimen carriers

Some areas of the hospital are served by porters who will carry samples to the laboratory but where this service is not available, it is essential that **anyone** carrying samples to the laboratory does so in accordance with the published laboratory guidelines - P04-005-F5 – “Guidelines for laboratory porters and messengers (including **all** staff carrying or handling samples for the laboratory)”. Specific laboratory containers (sealed red boxes) are provided for the safe transport of specimens to the laboratory from within the hospital, so samples **must not be carried in the hand or in a pocket**.

Transport services will collect samples from Primary Care and other local hospitals on an appropriate basis.

All staff transporting specimens to the laboratory should follow the guidelines issued (Guidelines for laboratory porters and messengers P05-005-F5) which is available on request.

Labelling for Danger of Infection

All Pathology specimens and request forms **MUST** be transported in bags identified with the “Biohazard” logo. Specimen containers and transport bags must be securely sealed.

Each request form should include sufficient clinical information; e.g. possibility of Tuberculosis; to enable laboratory personnel to adopt additional safety precautions.

Patients who have developed a fever within 21 days of having returned from Africa or other countries where Lassa Fever or other Viral Haemorrhagic Fevers occur or who through their work may have had contact with any of these viruses should be discussed with the department in Pathology before the collection or transport of specimens to establish a need for any special containment.

The majority of requests require no more than 7.5 ml. of blood. However, some tests may vary. For general enquiries please phone extension 2480.

Routine Service

Most assays listed are carried out daily. Results will usually be available on the day of request.

Urgent service

The majority of urgent samples will be analysed within one hour of receipt in the laboratory. This includes

- Renal, hepatic and bone profiles
- Glucose
- Magnesium
- CRP

- Paracetamol and Salicylate
- Amylase
- Blood gas analysis
- Qualitative Beta HCG in serum and urine
- Creatine Kinase
- CSF protein and glucose
- Lactate
- Troponin T (may not be analysed within one hour, and may delay the reporting of other tests)

Other tests will be analysed as soon as possible, but may not be available at all times. The requesting of tests not on this list may result in delayed reporting of all results.

Out of Hours Service

The pathology laboratory is open 7am – 12.30am every day. Samples are processed until midnight each day.

For tests required between midnight and 7am, please contact the Out-of-hours team through the hospital switchboard.

Samples will be analysed by Point-of-care devices, or transferred to the laboratory at Manchester Royal Infirmary

Blood Investigations

Unless otherwise stated all tests are performed on samples collected using a 7.5ml Sarstedt (brown top) bottle. For paediatric samples the White 1.7ml Sarstedt bottle should be used.

Please note that sample stability is for samples that have been separated and stored at 4C, and, unless stated, are measured in days. Additional tests may be requested within this time.

“Turnaround times” define the length of time between a sample being received in the laboratory and the report being released from the laboratory. Please note that these times are typical, and delays beyond the control of the laboratory may occur. Transit time of the sample to the laboratory and transit time of the report to the requester are not included in this time. This time is reported in days. Some tests are only analysed Monday to Friday 9am till 5pm, and as such may not be available over the weekend.

Some tests are analysed at other laboratories within the Trust. Any tests not analysed within the laboratory at Trafford General will be marked on the report.

Samples marked with a * are referred to another Trust. Please note that the turnaround times for referred work are based on the details given by the reference laboratory. Transportation delays may result in delays in receiving results.

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
General Chemistry				
Renal Profile		5	1	Sodium, Potassium, Creatinine (and Urea if in-patient)
Hepatic Profile		2	1	Total Bilirubin, Alkaline Phosphatase, Total Protein, Albumin, and ALT
Bone Profile		4	1	Total and Calculated Calcium, Alkaline Phosphatase, Albumin (and Phosphate if in-patient)
ALT (Alanine Aminotransferase)	5-40 U/L	7	1	Included in hepatic profile. Age related reference ranges are reported for children
Alcohol (Ethanol) in serum	Non-detected (<100 mg/L)	3	2	

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
ALP (Alkaline Phosphatase)	Male adults 40-129 U/L Female adults 35-104 U/L	7	1	Included in Bone profile and hepatic profile. Age related reference ranges are reported for children.
Albumin	34 - 48 g/L	150	1	Included in hepatic and bone profiles. Age related reference ranges are reported for children
Amylase	0 - 100 U/L	30	1	
Bicarbonate	22-26 mmol/l	1 hour	1	Lithium heparin sample required (orange top). Sample must be received with one hour
Bilirubin (Total)	<20 µmol/L	3	1	Included in hepatic profile Should be protected from light and analysed immediately
Bilirubin (Direct / Conjugated)	<5 µmol/L	7	1	Should be protected from light and analysed immediately
Calcium	2.10 – 2.60 mmol/L	21	1	Included in bone profile. Significant negative interference from EDTA contamination.
Corrected (or adjusted) Calcium	2.10 – 2.60 mmol/L	21	1	Corrected for albumin concentration. Included in bone profile. Age related reference ranges are reported for children
Carboxy Hb	Non-smokers <2% Smokers <10%		1	Lithium Heparin sample required
Chloride	96 – 108 mmol/L	5	1	
Cholesterol (Total)	Target < 4.0 mmol/L	5	1	Included in Random and Fasting lipid profiles

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
Cortisol	9am 150 - 650 Midnight 50 - 250 nmol/L	5	2	Prednisolone, methyl-prednisolone prednisone, 11-deoxycortisol and 21-hydroxycortisol may cause incorrect values to be reported
Creatinine	Male 59 - 104 Female 45-84 µmol/L	7	1	Included in renal profile. Antibiotics containing cephalosporin may lead to significant false positive values. Age related reference ranges are reported for children
Creatine Phosphokinase (CK, CPK)	Male 39-380 U/L Female 26-192 U/L	7	1	
CRP (C Reactive Protein)	<10 mg/L	60	1	
GGT (Gamma-Glutamyl-transferase)	Male 10-71 Female 6-42 U/L	7	1	Added by the lab with abnormal LFTs
Glucose – Fasting	Venous plasma 2 - 6.1 mmol/l	1	1	Fluoride oxalate sample (yellow top)
Glucose Tolerance Test	Fasting < 6.1 120min <7.8 mmol/L	1	1	Individual interpretation will be provided for each test based on the fasting and 2 hour glucose results
Haemoglobin A1c	Good control <59 mmol/mol Moderate control 59 – 74 Poor control > 74	4	2	Fluoride oxalate (yellow top) or EDTA (red top) sample. A separate sample from glucose or FBC should be collected The lower the HbA1c, the lower the risk of complications

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
HDL cholesterol	Male >1.0 Female >1.2 mmol/L	7	1	Included in both random and fasting lipid profiles. In rare cases, elevated immunoglobulin concentrations can lead to falsely increased HDL-cholesterol results.
Immunoglobulins		120	2	Age related reference ranges are reported for all patients
Iron	11 – 32 μmol/L	21	1	Unable to analyse haemolysed samples
Lactate	0.63 – 2.44 mmol/L	1 hour	3 hours	Fluoride oxalate (yellow top) sent to lab immediately.
Lactate Dehydrogenase (LD)	20 – 220 U/L	4	1	Positive interference from haemolysis. Age related reference ranges are reported for children
LDL Cholesterol	<2.0 mmol/L		1	Included in Fasting lipid profile. Calculated from total and HDL Cholesterol and Triglyceride. Triglyceride must be less than 4
Magnesium	0.7 – 1.1 mmol/L	7	1	Significant positive interference from haemolysis
Osmolality	275 – 295 mmol/kg	2	2	
Phosphate (Inorganic)	0.7 – 1.50 mmol/L	1	1	Performed as part of Bone profile on in-patients. Otherwise, must be requested on form. Significant positive interference from haemolysis
Potassium	3.5 – 5.3 mmol/L	1	1	Included in Renal profile. Significant positive interference from haemolysis. Raised platelets may cause spurious raised potassium. Contact lab for further details.
Total Protein	64 - 83 g/L	30	1	Included in Hepatic profile

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
Serum Protein Electrophoresis	No Paraprotein band seen	14	4	Individual interpretation is given for each sample. Plasma samples should not be used
Sodium	133 – 145 mmol/L	14	1	Included in Renal profile. Lipaemia may falsely lower sodium values
Transferrin	2.0-3.6 g/L	8	1	
Transferrin saturation	15 – 40 %	8	1	Calculated from Iron and transferrin measurements
Triglycerides	<1.7 mmol/L	5	1	Part of fasting lipid profile. Fasting specimen needed
Troponin T	Low risk < 14 ng/L If >14ng/L, take a second sample 6 hours later. An increase of >10 ng/L is clinically significant	1	1	Request forms must state details of time of sample in relation to chest pain. Haemolysis may cause falsely depressed results, and the sample will not be analysed
Urate	Male 200 - 430 Female 140 - 360 µmol/L	7	1	α-methyl dopa, desferoxamine and calcium-dobesilate can cause interference. Age related reference ranges are reported for children
Urea	2.5 – 7.0 mmol/L	7	1	Part of Renal profile inpatients only, otherwise request specifically on form
Vitamin D	Optimal Total Vitamin D >50 nmol/L		14	Interpretation is provided on the report

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
Blood Gas Analysis	pH 7.35 – 7.45 pCO₂ 4.5 – 6.1kPa pO₂ 12-15 kPa O₂ sats 95-100%	1hour	1 hour	Arterial or venous samples are collected into heparinised syringe. Collect Capillary samples into heparinised capillary tubes. Reference ranges are for arterial samples only. Send to lab immediately. Samples must be labelled and sent with a request form
Endocrinology				
Follicle Stimulating Hormone (FSH)	Post Menopause >25 IU/L Prepubertal 0.6-5.0 IU/L Male 1-7 IU/L	14	1	Follicular 2-10 IU/l Mid-Cycle 5-20 IU/l Luteal 1-7 IU/l
Luteinising Hormone (LH)	Post Menopause >25IU/l Prepubertal <0.5-2.2 IU/l	14	1	Follicular 2-12 IU/l Mid-Cycle 20-100 IU/l Luteal 2-11 IU/l
Oestrogen (E2)	Adult male 28-156 pmol/l	2	1	Follicular 46-607 pmol/l Mid-Cycle 315-1828 pmol/l Luteal 161-774 pmol/l
Parathyroid hormone (PTH)	15 – 65 pg/mL	20 hours	1	Requires EDTA specimen. Interpretation is dependent upon the calcium result, and will be added on a sample-by-sample basis.
Prolactin	Female 102-496 mIU/l Male 86-324 mIU/l	1	1	Macroprolactin will be analysed as appropriate; information regarding this can be obtained from the laboratory.

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
Progesterone	Follicular <5 nmol/l Luteal 5-95 nmol/l Consistent with ovulation >30 nmol/l	5	1	
Testosterone	Female 0.2 – 1.65 mmol/l Male (20-50 y) 8.7 – 29 Male (>50y) 6.9 – 25.8	2	1 (unless referred to reference lab)	Raised testosterone on females will be referred for further investigation. Paediatric sample will be referred to reference laboratory for analysis
Thyroid Function Test	FT4 10-26 pmol/l TSH 0.2 – 5.0 mU/l	2	1	
Therapeutic Drugs				
Carbamazepine	Target range 4-10 mg/L	2	7	Sample taken pre-dose for TDM Concern level 25.0 mg/L
Digoxin	Target range 1.0-2.0 µg/L	2	1	Applies to samples collected immediately pre-dose or at least 6 hours post dose. On changing dosage allow seven days before re-assay. Toxicity likely at levels >3µg/L
Gentamicin		2	1	Interpretation is dependent upon the dose given. Advice is available in the Antimicrobial policy

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
Lithium	0.6 – 1.0 mmol/L Elderly 0.4 – 0.8	7	1	Clotted blood collected 11 – 13 hours after last dose. Levels >1.0 mmol/L are considered toxic Must not send lithium heparin (orange top) sample.
Paracetamol	None detected	2	1	Should be collected at least 4 hours post overdose. Toxic tricyclic antidepressant levels may falsely lower paracetamol levels
Phenytoin	Target range 8 – 15mg/L	2	1	Please state patients' dose Concern level 20.0 mg/L
Salicylate	None detected	2	1	Concern level 350mg/L
Theophylline	Target range Adults 10.0-20.0 mg/L Under 1 year 6.8-14.8	2	1	For URGENT requests, the laboratory must be contacted before collection
Valproate	Target range 50-100 mg/L	2	1	Concern level above 150mg/L
Vancomycin		2	1	Interpretation is dependent upon the dose given. Advice is available in the Antimicrobial policy
Tumour markers				
Tumour markers should be used only as monitoring tests: they are not specific for malignancy and should only be requested if there is a histological diagnosis. Requesting of multiple markers to identify primary cancer is rarely of use.				
AFP (Alpha Fetoprotein)	<11 U/ml	7	2	
CA 19-9*	<35 kU/L		7	

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
CA-125	<35 kU/L	5	2	
CEA (Carcino-embryonic Antigen)	<3 kU/L	7	2	
PSA (Prostate Specific Antigen)	<60 years <3 µg/L <70 years <4 µg/L >70 years <4 µg/L	5	1	
β-HCG β – Human Chorionic Gonadotrophin	Male <2IU/L Female <5IU/L Post menopausal <8 IU/L	3	1	These reference ranges are not applicable in pregnancy
CSF, Urine and Faeces Tests				
For most random urines, except microalbumin, a sterile 60ml container is appropriate. In general, at least 10ml of urine is needed for each test. For 24-hour urines, the sample collection procedure must be followed. Microalbumin samples should be collected into the Urine Monovette sample tubes				
CSF Glucose	Approx 60% of plasma glucose	1	1	Collect into a fluoride oxalate container
CSF Lactate	None available	1 hour	1	Fluoride oxalate (yellow top) sent to lab immediately. Contact lab before sending
CSF Protein	0.15 – 0.40 g/L	3	1	Collect into a universal container. Presence of blood invalidates the test
CSF for Xanthochromia	No bilirubin or oxyhaemoglobin	1	3	Protect the CSF sample (4 th sample of LP) from the light.

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
Creatinine Clearance	60 – 120 ml/min	6	1	24h Urine and serum specimens are needed
Faecal sugar chromatography	None Detected	1 hour	14	Sample must be sent immediately to the lab on a biochemistry request form
Faecal Elastase	>200 mg/g		14	
Fluid Amylase		1	1	
Fluid Electrolytes		2	1	
Fluid LDH		2	1	Bloodstained samples are unsuitable for analysis
Fluid pH	>7.2	2 Hours	2 Hours	Sample must be collected anaerobically into a blood gas tube
Fluid Total Protein		2	1	Bloodstained samples are unsuitable for analysis
Urine amino-acid screen		3	21	Providing clinical details will assist interpretation
Urine Calcium	2.5-7.5 mmol/24hrs	4	1	Random urines acceptable
Urine Creatinine	8.8-17.6 mmol/24hrs	6	1	Random urines acceptable
Urine Drugs of Abuse*		3	14	Tests for the more commonly abused drugs.
Urine Electrophoresis		3	5	Individual interpretation is given for each sample. May be referred to as Bence Jones protein Send at least 15ml
Urine free Cortisol*	<165 nmol/24 hrs	6	8	
Urine Hydroxyindoles*	< 50 µmol/24h		14	Must be collected with an acid preservative. Dietary restrictions apply, please list medications on request form

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
Urine Microalbumin (Albumin : creatinine ratio)	Male <2.5 g/mol Female <3.5 g/mol	30	2	Collect into 10ml urine Monovette. Unsuitable for analysis in the presence of blood or protein. Raised microalbumin (>400mg/l) leads to protein: creatinine ratio being requested
Urine Mucopolysaccharides screen		3	21	Providing clinical details will assist interpretation
Urine Organic acid screen		3	21	Providing clinical details will assist interpretation
Urine Osmolality		2	2	Random urines preferred. 24hr urines acceptable
Urine Phosphate	16-44 mmol/24hrs	180	1	Random urines acceptable
Urine Potassium	25-125 mmol/24hrs	6	1	Random urines acceptable
Urine Pregnancy Test		3	1	A number of conditions other than pregnancy, including trophoblastic disease and other neoplasms can cause positive results
Urine Protein	<0.15 g/24hr	2	1	Positive interference from any blood present in the urine
Urine Protein: Creatinine Ratio	<25 mg/mmol	2	2	Unsuitable for analysis in the presence of blood
Urine Sodium	40-220 mmol/24hrs	14	1	Random urines acceptable
Urine sugar chromatography	None Detected	1 hour	14	Sample must be sent immediately to the lab on a biochemistry request form
Urine Laxative Screen*	None Detected	14	15	Greater than 15ml sample needed. Ideally send samples from 3 consecutive days.
Urine Urate	3.6-4.1 mmol/24hrs		1	Random urines acceptable

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
Urine Urea	250-570 mmol/24hrs	7	1	Random urines acceptable
Miscellaneous referred work				
17-OH progesterone	0 – 6 nmol/L		14	
Alpha-1 Antitrypsin	1 – 2 g/L		8	Sample will be referred for phenotyping if result <1.2
ACE*	20 – 70	6	5	
Adrenocortico-trophic Hormone (ACTH)*	< 46 ng/L at 0930	1 hour	6	Lithium-heparin sample. Must be received within one hour. Unsuitable if haemolysed
Aldosterone: Renin ratio*	Aldosterone <630pmol/L Renin 0.3-2.2 nmol/L/hr	1	12	EDTA sample. Must be received within one hour
Antimullerian hormone		24 hours	14	
Ammonia	<40 µmol/L	15 mins	2	Requires paediatric EDTA tube. Must be received on ice within 15 minutes. Contact lab before collecting. Haemolysed samples unsuitable
Apo E Genotyping*			21	Interpretive result
Beta 2 Microglobulin	<3 mg/L		7	Requires separate serum sample
Caeruloplasmin	0.25 – 0.63 g/L		9	
Cobalt			16	EDTA sample. MHRA threshold: Cobalt 7ppb equivalent to 120nmol/L
Chromium			16	EDTA sample. MHRA threshold: Chromium 7ppb equivalent to 135nmol/L

Test	Reference ranges	Stability (days)	Turnaround time (days)	Notes
C-Peptide	350 – 1800 pmol/L	20 mins	28	Must be received within 20 minutes on ice
Copper	11 – 20 µmol/L		28	
Cyclosporin	100 – 300 µg/L		7	EDTA sample
Free light chains	Free K 3.3 - 19.40 mg/L Free λ 5.7 – 26.30 mg/L Ratio 0.26 – 1.65		7	Requires separate serum sample
Free T3*	2.6-5.7 pmol/L		7	
Gut Hormone profile*		15 mins	16	Requires 2x 7.5ml EDTA samples Interpretation provided on report
Insulin	2.3 – 26.0 mIU/L (fasting)	30 mins	16	Must be received, on ice, within 30 minutes. Haemolysed samples unsuitable for analysis
Lamotrigine	3 – 15 mg/L		9	
Orosomucoid*	0.5 – 1.2 g/L		7	
P3NP (Procollagen Peptide)	1.7 – 4.2 ug/L		28	
Androgen profile*		2	16	Interpretation provided on report
TPMT*	68 – 150 mU/L	6	14	Requires 2x EDTA samples
Thiopurine metabolites*		7	14	235-450 pmol 6TGN / 8x10 ⁸ cells – Maximum drug efficacy >5700 pmol 6MMPN /8x10 ⁸ cells – Associated with increased risk of hepatotoxicity
Zinc	12 – 22µmol/L		16	

Referred Work

Although the majority of samples are processed in the laboratory at Trafford, or at Central Manchester University Hospitals, some less frequently requested tests are referred to other hospitals. These tests are noted on the report, which states the referral laboratory used. The most commonly used laboratories are

Wythenshawe Hospital

Department of Biochemistry
University Hospital of South Manchester
Wythenshawe Hospital
Southmoor Road
Manchester
M23 9LT

Salford Royal Hospital

Department of Chemical Pathology
Phase 1 Laboratories Reception
Level 2
Hope Hospital
Stott Lane
Salford
M6 8HD

City Hospital Birmingham

Clinical Biochemistry
City Hospital
Dudley Road
Birmingham
B18 7QH

Sheffield Protein Reference Unit

Protein Reference Unit
Department of Immunology
PO BOX 894
Sheffield
S5 7YT

Quality Assurance Programmes

As part of our on-going commitment to Quality and service improvement, we participate in all appropriate National Quality Assurance schemes for Chemical Pathology.

Internal Quality Control

Comprehensive internal quality control procedures are followed in Chemical Pathology, covering all aspects of work in the laboratory.

References

Title	Source
Safe Working and the prevention of infection in clinical laboratories and similar facilities 2003	Health Services Advisory Committee
Disinfection, decontamination and biological spillage procedure	Pathology management procedure
Pathology Quality Manual	Trafford Division, Central Manchester NHS Trust
A Practical Guide to Accreditation in Laboratory Medicine	David Burnett
Standards for the Medical Laboratory	Clinical Pathology Accreditation (UK) Ltd
Antimicrobial Policy and Empirical Guidelines for Adult patients	Antimicrobial Sub-group, Medicines Management Committee, Clinical Standards Committee
Guidelines for laboratory porters and messengers	P05-005-F5